# 340034 - SIME-F4O12 - Mechanical Systems

**Coordinating unit:** 340 - EPSEVG - Vilanova i la Geltrú School of Engineering  
**Teaching unit:** 712 - EM - Department of Mechanical Engineering  
**Academic year:** 2017  
**Degree:** BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)  
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)  
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)  
**ECTS credits:** 6  
**Teaching languages:** Catalan

## Degree competences to which the subject contributes

### Specific:
1. CE13. Knowledge of theatrical basics of machines and mechanisms  
2. CE14. Knowledge and application of basics of material resistance.

### Transversal:
3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.  
4. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

## Teaching methodology

The sessions are divided into classes of theory, problems and laboratory practices. Theory classes integrate the presentation of the basic theoretical concepts of thematic content of the course and applied examples are described as exercises.  
In the classes of problems, the teacher presents exercises for applying the concepts studied in theory classes and proposes others for resolution by the student, individually or in groups.  
In the laboratory practical classes, experimental tests are developed and is the student, individually or in groups, who must work aspects ruled by the teacher.

## Learning objectives of the subject

When finishing the subject, the student should be able to:  

- Analyze structures and give them dimension.  
- Define and apply the principles of machines and mechanisms.  
- Define and correctly apply the principles of strength of materials.  
- Write texts with the appropriate structure for communication purposes.
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Presents the text to an audience with the strategies and appropriate means.
Define and puts into practice methods of teamwork.

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>Hours medium group:</th>
<th>Hours small group:</th>
<th>Guided activities:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total learning time: 150h</td>
<td>52h 30m</td>
<td>0h</td>
<td>7h 30m</td>
<td>0h</td>
<td>90h</td>
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<td>35.00%</td>
<td>0.00%</td>
<td>5.00%</td>
<td>0.00%</td>
<td>60.00%</td>
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# Content

## 1 - Kinematics of mechanisms

<table>
<thead>
<tr>
<th>Learning time: 15h</th>
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<tbody>
<tr>
<td>Theory classes: 4h</td>
</tr>
<tr>
<td>Practical classes: 0h</td>
</tr>
<tr>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td>Self study: 9h</td>
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</tbody>
</table>

**Description:**
- 1.1 Structural analysis of mechanisms.
- 1.2 Analysis of velocities.
- 1.3 Analysis of accelerations.

**Specific objectives:**
After completing this unit the student should be able to:
- Analyze the elements that are part of a mechanism and determine its degrees of freedom.
- Determine a rigid body, the linear speed and acceleration of a point, and the angular velocity and acceleration of the solid, from the kinematic data sufficient.
- Perform the kinematic study of mechanisms.

## 2 - Statics of mechanisms

<table>
<thead>
<tr>
<th>Learning time: 10h</th>
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<tbody>
<tr>
<td>Theory classes: 4h</td>
</tr>
<tr>
<td>Practical classes: 0h</td>
</tr>
<tr>
<td>Laboratory classes: 0h</td>
</tr>
<tr>
<td>Self study: 6h</td>
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**Description:**
- 2.1 Introduction
  - 1st and 3rd Newton's law.
  - Basic concepts: rigid body, force, mass and weight.
  - Free body diagrams.
  - Equations of equilibrium of a rigid body.
  - Moment of a force about a point.
  - Concept of Coulomb friction force.
- 2.2 Problems of statics of rigid bodies.
- 2.3 Problems of statics in mechanisms.
- 2.4 Virtual Power's Theorem

**Specific objectives:**
At the end of this unit the student should be able to:
- To solve problems of statics of rigid bodies.
- To solve problems of statics of mechanisms.
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<table>
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<tr>
<th>3 - Dynamics of mechanisms</th>
<th>Learning time: 15h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 4h</td>
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<tr>
<td></td>
<td>Practical classes: 0h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Self study : 9h</td>
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**Description:**

3.1 Theorem of energy
   - Work of a conservative force
   - Work of a frictional force
   - Work of a conservative moment
   - Work of a moment of friction
   - Kinetic energy of a mechanism

3.2 2nd law of Newton and D'Alembert method
   - Inertial force
   - Moment of inertia
   - Moment due to inertia
   - Dynamic Friction

**Specific objectives:**

At the end of this unit the student should be able to:

- Solve problems of dynamics by D'Alembert method.
### 4 - Mechanics of deformable solid

**Learning time:** 38h  
Theory classes: 12h  
Practical classes: 0h  
Laboratory classes: 0h  
Self study: 26h

<table>
<thead>
<tr>
<th>Description:</th>
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| 4.1 Introduction to the strength and elasticity of materials.  
Hooke's law and stress-strain diagram.  
4.2 Simple solicitations.  
Traction-compression.  
Shear.  
Torque.  
Flexion. |

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<thead>
<tr>
<th>Specific objectives:</th>
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<tr>
<td>The objective of this module is to understand that the components of a mechanical system are not deformable or indefinitely resistant to the forces they are subjected. We introduce the basic concepts of theory of elasticity and strength of materials in order to determine what stresses occur inside a body, and what deformations occur, according to external forces, the dimensions and the material the element is constructed. The purpose of this study is to size the different elements of a system to meet certain requirements of loads and deformations, or based on an existing design, to determine the extreme conditions, ensuring that the element works within a margin of safety.</td>
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<tr>
<th>Individual assessment tests</th>
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</table>
| **Learning time:** 27h  
Theory classes: 10h  
Self study: 17h |

<table>
<thead>
<tr>
<th>Description:</th>
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| 5.1 Variables cinemàtiques  
5.2 Moviments simples del sòlid rígid  
5.3 Centres Instantànis de Rotació  
5.4 Composició de moviments |

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<th>(ENG) -</th>
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| **Learning time:** 18h  
Theory classes: 6h  
Self study: 12h |
The final grade of the subject is determined from the expression:

\[ N = AC \cdot 12.10 + PR \cdot 12.15 + Amsden \cdot 12.10 + \max [(AP \cdot 12.25 + AF \cdot 12.40), AF \cdot 0.65] \]

where

- \( AC \) are different evaluable activities that are proposed during the course
- \( PR \) laboratory practices
- \( Amsden \) is an evaluation of the subject of mechanical of deformable solids
- \( AP \) is the partial evaluation
- \( AF \) is the final evaluation

There is a reevaluation test that you can do when the grade of the subject is superior to 3 and inferior to 5, and in which you reevaluate 75% corresponding to the exams (it is said, 25% portion corresponding to the continuous evaluation of practices and other activities proposed in the course is not reassessable).

### Qualification system

The conditions of realization of each test, will be specified in each particular case, in good time.

### Bibliography

**Basic:**


**Complementary:**